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Six hundred and forty-sixth Meeting.

June 4, 1872. — ADJOURNED ANNUAL MEETING.

The PRESIDENT in the chair.

Dr. Maack gave a description of the explorations he has been making on the Isthmus of Panama.

Professor N. S. Shaler presented a communication on the topography of Narragansett Bay.

The Annual Report of the Council was presented by Professor Joseph Lovering, the Corresponding Secretary, and ordered to be printed.

Since the last report of the Council the following additions, by election, have been made to the membership of the Academy: —

Francis L. Pourtales, of Cambridge, to be a Resident Fellow in Class II., Section 3.

Robert Amory, of Brookline, to be a Resident Fellow in Class II., Section 3.

R. W. Hooper, of Boston, to be a Resident Fellow in Class II., Section 4.

J. B. Perry,* of Cambridge, to be a Resident Fellow in Class II., Section 1.

S. P. Sharples, of Cambridge, to be a Resident Fellow in Class I., Section 3.

G. R. Baldwin, of Quebec, to be a Resident Fellow in Class I., Section 4.

H. G. Denny, of Boston, to be a Resident Fellow in Class III., Section 2.

John Trowbridge, of Cambridge, to be a Resident Fellow in Class I., Section 3.

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* Printed J. B. Pettee, by mistake, on page 335.

J. A. Allen, of Cambridge, to be a Resident Fellow in Class II., Section 3.

William H. Pettee, of Cambridge, to be a Resident Fellow in Class II., Section 1.

John K. Paine, of Cambridge, to be a Resident Fellow in Class III., Section 4.

Edwin P. Seaver, of Cambridge, to be a Resident Fellow in Class I., Section 1.

Charles F. Dunbar, of Cambridge, to be a Resident Fellow in Class III., Section 3.

William A. Rogers, of Cambridge, to be a Resident Fellow in Class I., Section 2.

Samuel Johnson, of New Haven, to be an Associate Fellow in Class I., Section 3.

Charles A. Young, of Hanover, N. H., to be an Associate Fellow in Class I., Section 2.

Leo Lesquereux, of Columbus, Ohio, to be an Associate Fellow in Class II., Section 2.

Since the last annual meeting, the Academy has lost by death nine Foreign Honorary Members, four Associate Fellows, and three Resident Fellows.

GEORGE GROTE died in London, June 18, 1871. He was born November 17, 1794, at Beckenham, Kent, and received his early education at the Charterhouse School. At the age of sixteen he entered the banking-house of Prescott, Grote, & Co., in London, of which his grandfather had been the founder, and in which his father was still a partner. It was a strange fate which sent to a bank rather than to the university a young man of ample means, already inspired with a love of ancient learning, who was destined to revolutionize the opinions of scholars on important points of Grecian history, antiquities, and philosophy, and to make himself a recognized authority on these subjects, not merely at home, but even among the most learned scholars of the Continent. Considering the period at which he would have entered academic life, we may, perhaps, doubt whether the fate that guided him was not propitious to the cause of learning. His own studies, conducted without teachers, and perhaps not without a little willing opposition to the traditions of English scholarship, led him into the purer and freer air and to the wider views of German learning, at a time when he might have found Oxford and Cambridge still singing the old song, "The Germans at Greek are sadly to seek." It must, indeed, have been no ordinary enthusiasm that impelled a young man, under such circumstances, to undertake what is perhaps the most thorough study of the whole Greek literature — poets, historians, and philosophers — ever accomplished by a self-educated man in modern times. It was not, as has sometimes been thought, his parliamentary experience that caused him to study the constitution of ancient Athens; nine years before he entered public life we find him preparing for his History of Greece, the first volume of which, however, was not published until 1846, twenty-three years later. The original research and the profound learning which this work displayed, even in its earliest volumes, testify to long years of hard and patient study. There is no easy or short road to learning of this nature. In 1832, his literary labors were interrupted by his election to the House of Commons as member for the city of London. He remained in Parliament nine years, and distinguished himself especially by what was called his "annual motion" for the ballot. In his later years, when his favorite scheme was brought into Parliament as a ministerial measure, he could well afford to smile at the ridicule with which it was once greeted on all sides. His public life delayed, perhaps fortunately, the publication of his History. In the mean time, Thirlwall's "History of Greece" appeared, which took an immense step in advance of the Tory views of Mitford, but did not aim at such an overthrow of English opinions and prejudices about Greek democracy as Grote contemplated. That literary men, even out of England, were expecting Grote's History with interest, appears from a letter of Niebuhr (who died in 1831), in which he advised a friend to translate the coming work into German as soon as it should be published. In the years 1846 – 1856 were published the twelve volumes of Grote's "History of Greece." Nine years later was published his other important work, "Plato, and the other Companions of Sokrates," in three volumes. If his History astonished scholars by the intimate acquaintance of a self-educated man with the Greek historians and poets, his Plato called forth new surprise, that a man so pre-eminently practical as Mr. Grote, whose sober common-sense was one of his great virtues as an historian, should prove equally familiar with the great idealist of antiquity, whose whole mode of thought and reasoning was in constant conflict with his own. It often seems, indeed, as if the pleasure of refuting the many absurd theories which were current about Plato and his works made up to Mr. Grote for the patient toil by which he must have mastered many elaborate and often tedious arguments of the Platonic Socrates, leading to conclusions the furthest possible removed from his own sympathies. At the time of his death, he was preparing for the press a similar work on Aristotle; and it can hardly be doubted that the same sagacity, joined with a deeper sympathy with the author and the subject, would have made this the crowning work of his life. It remains to be seen how far the posthumous work, now daily expected, will realize the expectations of scholars.

It was not to be expected that the graduate of a London bank, who had known no higher institution of learning than the Charterhouse School, should be as familiar with all the nice details of classical scholarship as if he had been trained at a university. But no modern historian of Greece was ever more thoroughly imbued with the whole spirit of classical antiquity, or ever viewed the field from a more commanding position. Although his views have often been violently attacked, and especially his defence of Athenian democracy in its least defensible points, his writings have yet produced a gradual change in the feelings of nearly all scholars towards even the weaknesses of Athens. No one, for example, will ever again attack the Sophists indiscriminately as a corrupt sect of philosophers, with a common creed and a common purpose of corrupting the youth of Athens. Even Cleon, that coarsest product of Attic democracy, will perhaps fare a little better at the hands of subsequent historians for having found a friend in Mr. Grote; it may be doubted, however, whether the historian would not have understood Cleon and his class better if he had spent nine years in Congress instead of in Parliament. Perhaps nothing in Grote's works has been so severely criticised as his defence of ostracism; and yet it was defended on nearly the same grounds by Aristotle, when it was almost as much a thing of the past as it now is.

During the later years of his life, Mr. Grote was Vice-Chancellor of the University of London, and one of the Trustees of the British Museum. It is understood that he was offered a peerage about two years before his death, and declined it on the ground that he must devote the remainder of his strength to his work on Aristotle. The long list of honorary titles which have been gradually added to the simple "George Grote, Esq.," which appears on the title-page of his History, show the respect in which he was held by scholars at home and abroad; and the impressive funeral service at his grave in Westminster Abbey, in which the highest officers of state appeared as mourners, was a fitting testimonial to the modest scholar, who had done more than any other man of the present generation to exalt the name of England in the department of ancient learning.

(AUGUST) IMMANUEL BEKKER was born in Berlin, May 21, 1785. He studied at the gymnasium of his native city, and in 1803 he entered the University of Halle, where the great founder of the modern school of German classical philology, Friedrich August Wolf, was at the height of his reputation as a lecturer. Wolf was not long in discovering the ability and the persevering patience of his scholar, and the relations between the master and the pupil soon became intimate. Bekker was retained at Halle, after his regular term of study was ended, as assistant to Wolf in the Philological Seminary. While he was a student, he wrote his review of Heyne's smaller edition of the Iliad, which appeared in the Jena *Allgemeine Litteratur Zeitung*, in 1806, and was afterwards reprinted, in 1863, in Bekker's *Homerische Blätter*. The boldness with which he attacked the weak points in Heyne's work is in strange contrast with the gentleness which distinguished the great critic in his later years; and, on reprinting the review fifty-seven years afterwards, Bekker apologizes for the "jugendliche Keckheit" of his first essay, the tone of which (he says) was approved and encouraged by his master and patron, Wolf. As to Heyne, he confesses that, as a young man of twenty, he knew him only as a grammarian, "den vielseitigen von Einer, und der schwachen, Seite." His review of Wolf's Homer, published in 1809, in a more respectful but decidedly critical spirit, did not meet the same unqualified approval of his master, if we may judge by a note of Wolf, which Bekker quotes in the preface to the *Homerische Blätter*.

In 1810, Wolf was called from Halle to a professorship in the new University of Berlin; and Bekker soon followed, through Wolf's influence, as extraordinary professor. In the very year of his appointment, Bekker received a leave of absence, to enable him to begin the labor to which no small part of his active life was to be devoted, that of collating classic manuscripts. He went first to Paris, and the earliest fruit of his labors appeared in 1811, in the publication of the important grammatical work of Apollonius Dyscolus, *De Pronomine*, never before printed. In 1812, he was appointed to a full professorship at Berlin, which office he held fifty-nine years, until his death in June, 1871. Bekker spent, according to his own estimate, seventeen years of his life in collating manuscripts in France, England, Germany, and Italy; and the present generation of classical scholars are, perhaps, too little aware of the debt of gratitude which they owe to this quiet, indefatigable worker. It would be easier to enumerate the Greek authors who were not edited by Bekker than those who were. The shelves of every classical library will soon supply more names than any two other editors could claim; and the critical apparatus with which his editions of the most important authors were enriched has been of more permanent value than any exegetical commentary. We may mention his editions of Plato (1816, 1817), of Thucydides (1821), of the Attic Orators (Oxford, 1822, 1823; Berlin, 1823, 1824), of Herodotus (1826), of Aristophanes (1829), of Aristotle (Berlin, 1831 - 1836; Oxford, 1837), and of Homer (1843, Iliad; 1858, Iliad and Odyssey). We may mention, among his editions of Latin authors, those of Livy (1829, 1830) and of Tacitus (1831). In many cases, the labors of Bekker have served, or are still serving, as a basis for later scholars to determine the authentic text. A striking instance of this may be seen in Bekker's later edition of Demosthenes (1854), in which a text is given which differs on every page from that of the *Oratores Attici* (1823), but which could never have been determined with such certainty without the careful collation of fifteen manuscripts which the earlier work contains. It needed the experience of the earlier edition to show Bekker himself the true use of his immense material, and to determine the principles of criticism on which the text of Demosthenes is now by universal consent established with as great certainty as we can ever hope to attain in the text of a classic author.

Bekker seems never to have distinguished himself as a public lecturer at Berlin in any degree proportionate to his fame and merit as a scholar. He preferred his more quiet work in the library to giving instruction to classes; and students who knew him only as a professor (if any such there were) could never have appreciated his profound scholarship and his critical sagacity. His dislike of long commentaries and *prolegomena* often kept him utterly silent when he alone could have spoken with authority; and when he broke his rule, and wrote a note or a preface, his brevity was often more tantalizing than his silence. His conversation was marked by the same laconic brevity as his writings; and the remark of an intimate friend, "Er schweigt in sieben Sprachen," was one of the commonplaces of Berlin society. Notwithstanding his retiring disposition, his company was eagerly sought by the most cultivated scholars, and his hospitable house in Berlin was one of their most frequent resorts. No scholar, perhaps, ever lived, at least in Germany, who had stronger friends, greater admirers, or fewer enemies than Immanuel Bekker.

Sir Roderick Impey Murchison died on the 22d of October, 1871, in his eightieth year. In his death the world has lost one who, in the popular estimation, not only shared with Lyell the sceptre of dominion among British geologists, but held, conjointly with him, a sort of universal empire. The labors of both of these men have extended beyond their country, and they have made not only Europe but America tributary to their reputation. Of these two, Lyell still remains, and, as his latest work, published in 1870, shows, retains unimpaired that clearness of style and that rare philosophic acumen which have made his masterpiece the *Principia* of modern geology, — a classic which future generations will study with the same delight as the present. Very different have been labors, and unlike the gifts of Murchison. Like Lyell and his distinguished predecessors, the earlier prophets of the Scottish school of geology, — Hutton and Playfair, — Murchison was a Scot, and was proud of his ancient Celtic pedigree. It is characteristic of the man, that, a few years since, he raised in the Highlands of his native land a monument to one of his Jacobite ancestors, who had sacrified fortune and life in the cause of the exiled Stuarts. The father of Sir Roderick was a physician who, in the last century, amassed a fortune in India, where he was a friend of the noted Elijah Impey. Marrying soon after his return, he purchased an estate at Tarradale in Rosshire, where his son, the subject of the present notice, was born in 1792, and was early left an orphan by the death of his father.

Like many others who have gained an honorable name in British geology, Murchison had not the advantage of a university training; but, after some years at a grammar-school in Durham, entered the army at the age of sixteen, and was soon ordered to Spain, where he served with distinction under Wellington; carrying the colors of his regiment in a desperate charge at Vimieira, and being left wounded on the field at Corunna. At the close of the war, he left the service, a captain of dragoons, and, returning to England, married in 1815. Possessed of wealth and social position, he seems for the next few years to have given himself to fox-hunting and the usual amusements of his class;

and he is said to have been first led to study by his wife's fondness for natural history. Meeting in 1818 with Sir Humphry Davy, he was induced, by his advice, to follow the lectures of the Royal Institution in London: and shortly afterwards placed himself under the tuition of Professor Richard Phillips, the well-known mineralogist. The attention of Murchison was soon drawn to the study of geology, then taking shape from the labors of Cuvier, Buckland, and Conybeare; but it was not until 1825 that he made his first contribution to the science, in a paper on the geology of parts of Sussex and the adjoining counties. Already he had formed an acquaintance with William Smith, who, by his careful studies of organic fossils and their stratigraphical relations, had laid the foundations of British geology. It was also his great good fortune to know Sedgwick, then commencing his laborious career, who became for many years his friend and companion in the field, and with whom, in 1827, he visited the Highlands of Scotland. In 1828, Murchison accompanied Lyell in a journey to the volcanic districts of central France, to northern Italy and the eastern Alps; and to the latter region he returned and labored with Sedgwick in 1829 and 1830. In 1831, he and Sedgwick began simultaneously, in different districts, the task of discovering the geological succession of the older fossiliferous rocks of Wales, of which they first gave the definite results to the world in 1834 and 1835. The fruits of Murchison's labors in this field were published in 1838 – 39, in two magnificent volumes, entitled "The Silurian System," and dedicated to his friend Sedgwick. Meanwhile, in 1836 and 1837, the two friends labored together in the investigation of the geology of Cornwall and Devonshire, and in 1839 extended their studies to the Rhenish country and to the Hartz Mountains, publishing conjointly their results.

In 1840, Murchison was invited to Russia by the Czar, and there spent two or three years with De Verneuil and Von Keyserling in investigating the geology of that country. The results of these labors, extending over the greater part of European Russia, appeared in 1845, as the joint production of Murchison and his fellow-workers. He subsequently made repeated visits for the purpose of geological investigation to Scandinavia, Germany, and the Alps; and in 1856, in conjunction with Professor Nicoll, published a valuable geological map of Europe.

In 1854 appeared the first edition of his well-known book, *Siluria;* which, besides a revision of his work done twenty years before, in the Silurian region of Great Britain, contained an excellent summary of the paleozoic geology of Europe. Of this volume four editions have appeared, the last in 1867, much augmented, and in great part re-written.

In 1855, on the death of Sir Henry de la Beche, Murchison was named in his place as director-general of the Geological Survey of the United Kingdom, a post which he resigned not long before his death. His activity as a geological investigator still continued. From 1855 to 1860 he turned his attention towards the Highlands of Scotland; and in 1861 published, in connection with Professor Archibald Giekie, a geological map of Scotland, with an introductory sketch, which is a valuable contribution to the literature of the subject, and sets forth briefly the great differences of opinion which had arisen between Murchison and his friend Professor Nicoll, as to the geological age of the crystalline schists of the Scottish Highlands. Besides the works already noticed, Murchison is said to have published during his long scientific career, extending over forty-five years, more than one hundred memoirs by himself on British and Continental geology, besides upwards of twenty in connection with other investigators.

The secret of his scientific success is to be found, in great part, in his methodical habits and his untiring industry. The observations of each day in the field were written out fully at night, and, while in town, the early hours of the morning were devoted to his literary labors. Murchison's scientific services were such as could not fail to attract attention and receive acknowledgment. To his scientific honors, which culminated in 1868 in his election as one of the eight foreign members of the French Academy of Sciences, were added titles and distinctions from princes and governments, both at home and abroad, among them the rank of Baronet of the United Kingdom. If these well-earned social honors were highly prized, no less by the courtier than the *savant*, it may be fairly said that he regarded them as a homage paid through him to science, and that he strove to turn them to good account in its service, as became his genial and kindly nature.

In forming an estimate of his scientific character, it must be said that his works show no such extensive acquaintance with geological history and literature as those of Lyell. He was not learned in chemistry, mineralogy, nor lithology; and, although skilfully availing himself of the evidences furnished by organic fossils, owed his paleontological determinations to others. His great merit as a geologist seems to have been a quick perception of the aspects of the rocks, and a happy facility in grouping and presenting the facts and observations of himself and others. Professor Giekie, in a recent biographical sketch, speaks of the rare acumen with which Murchison seized the geographical details of a region, and thence deduced the general arrangement of its rocks. His opinions, however, were either adopted from others, without much critical examination, or, in the case of his own observations, often formed hastily, and upon insufficient data; and very many of his conclusions are already inadmissible. Most of his deductions in the geology of the Alps appear, when viewed in the light which Studer, Lory, Pillet, and especially Favre, have thrown upon that region, to be fallacious. His conclusions as to the age and geological structure of the Scottish Highlands, although sustained by the members of the government survey, are rejected, apparently with good reason, by Professor Nicoll; while the subsequent investigations of Sedgwick and of the government surveyors have long since shown that the arrangement of the rocks to which he gave the name of Lower Silurian was based upon a series of mistakes in observation, and that the rocks thus called are identical with the upper division of the Cambrian series of Sedgwick. The history of the Cambrian and Silurian controversy, which alienated him from his old friend Sedgwick, and for the last thirty years has troubled geological nomenclature, is a long one, which has been lately fully discussed elsewhere. Indeed, it would appear that the nomenclature and classification of Murchison, hitherto so generally adopted for the paleozoic rocks, will be replaced by that of Sedgwick, the exactitude of whose early stratigraphical determinations has been fully established by the results of recent investigators both in Europe and America.

FREDERIC ADOLF TRENDELENBURG, Perpetual Secretary of the section of history and philosophy in the Royal Academy of Sciences at Berlin, and a Foreign Honorary Member of this Academy, died in Berlin in January, 1872. In him we regret the loss of one of the great metaphysicians of his country, the most eminent, indeed, as a scholar and a thinker in the department of philosophy, that Germany could boast of since the death of Hegel, Herbart, and Schelling. With these illustrious men his own name must always be associated, not as one who subscribed to their doctrines, but who followed generally the same lines of investigation, and by an acute, learned, and comprehensive criticism of their writings prepared the way for the reception of his own metaphysical theories. Whatever their adherents and followers may have thought of the justice of this criticism, none denied its ability, or the fairness with which it was stated, or the competency of its author, arising from his thorough comprehension of the systems which he impugned, to judge of their merits. As a dialectician, he was unrivalled among German professors of philosophy. But he was also something more and better. He thought and wrote on the most abstruse subjects with singular clearness, precision, and elegance, and with more caution and good sense, and a stricter regard for the great interests of morality and society, than was common with many of the able speculatists who had preceded him in a chair of philosophy in a German university. Of the merits of the peculiar system which he propounded in his principal work, the *Logische Untersuchungen*, first published in 1840, and which passed to a third edition only two years ago, we must speak with less confidence. Whether motion is the common and characteristic function both of matter and mind, and whether motion directed by purpose or final cause supplies the means of bridging over the abyss between thought and real being, is more than most metaphysicians of the present day will acknowledge. Those who may arise in some future age, more competent to settle grave disputes of this nature, must decide. But some of the doctrines and arguments incidentally developed in setting forth the main features of his system will always commend themselves to sober judges, as evidences of the dialectical shrewdness, the sterling common-sense, and the justness of thought of their author.

Trendelenburg seems to have left but few materials for biography. Indefatigable as a student and with his pen, a list of his writings is, in the main, a history of his life. Born at Eutin in Oldenburg, in November, 1802, he studied at Kiel and Leipsic, took the degree of Doctor in Philosophy in 1826, and was appointed Professor of Philosophy in the University at Berlin in 1833, two years after the death of Hegel. He first occupied himself with the works of Aristotle, an edition of whose *De Anima* he published in 1833. This was followed, four years later, by the *Elementa Logices Aristotelicæ*, which is a standard work on the subject, and arrived at the honors of a fourth edition in 1852. A "History of the Doctrine of the Categories," first published in 1846, subsequently appeared as the first volume of the *Historische Beiträge*, the three later volumes of this work, completed in 1867, being occupied with a collection of the memoirs, critical and philosophical, which he had contributed at various times to the "Transactions of the Royal Academy." As the result of his inquiries respecting the nature and foundations of morality, he published a work entitled *Naturrecht auf dem Grunde der Ethik*, which appeared in a second edition in 1868. Second only to the "Logical Researches," this book was the most thoughtful and original of his writings, and the most characteristic of the man. Several smaller essays on the theory of æsthetics need not be here enumerated.

In 1849, probably to his own astonishment, the city of Berlin elected him as one of its members to the lower house of the National Assembly. Here he generally voted with the conservative party, and published an essay on the methods of voting (*über die Methode bei Abstimmungen*). When the cause of the union of Germany was abandoned, he resigned his seat in the house, in 1851, and went back to those academic labors which occupied his whole life, with the exception of this brief political episode.

HENRY LONGUEVILLE MANSEL, D. D., Dean of St. Paul's, died in London, July 31, 1871. Though he had not completed his fifty-first year, he had done the work of a long life. His publications were numerous and important, exerting manifest influence on the course of speculative thought not only in England, but wherever the moral sciences had a home. As a scholar and a thinker in the various departments of philosophy, he had hardly a rival on English ground after the death of Sir William Hamilton. Equally eminent in logic, metaphysics, natural and doctrinal theology, his writings never failed to attract notice and command respect, though they often excited vehement controversy. His Brampton Lectures on the "Limits of Religious Thought," first published in 1858, when he was but thirty-eight years old, passed through three editions in a twelvemonth, and have probably affected the character of English thought in philosophy and theology more than any single work which has appeared since the days of Bishop Butler. In the earnest discussions which it immediately occasioned, and in which such distinguished men as F. D. Maurice, James Martineau, Goldwin Smith, and John S. Mill had a prominent share, Mr. Mansel appeared to great advantage. His stores of learning were immense; equally at home in Greek and German philosophy, in the speculations of the Schoolmen, and in the writings of the fathers of the

English Church, with almost unrivalled powers of clear statement and forcible argumentation, and a great mastery of English style, he either obtained an easy victory over his eminent opponents, or, even in the judgment of their disciples and admirers, left them no cause for triumph. Yet he was modest and candid in manner, an urbane and dignified controversialist, disarming his assailants as much by his flowing courtesy and frank acknowledgment of their claims to respect, as by his dialectical skill and abundant erudition. Once only, when provoked by continuous misrepresentations no less than by coarse invective and sneers, he retorted with terrible severity, and compelled his opponent to make an apologetic defence. This was the only unpleasant episode in Mr. Mansel's brilliant and prosperous career. His genial manners, ready wit, and quick sympathy with others, made him a great favorite in a large circle of acquaintances and friends. Even as a politician — and he was for years a leader of the conservative party at Oxford — he incurred no enmities and gave no personal offence. The manliness and simplicity of his character allowed no hold for envy or jealousy; and it cost him no effort to gain and preserve great personal popularity.

The family of Dean Mansel was distinguished before his time both in the universities and the Church. One member of it had been Master of Trinity College, Cambridge, and another was Bishop of Bath and Bristol. His father was Rector of Cosgrove, Northamptonshire, a family living, where the late Dean was born on the 6th of October, 1820. Educated at Merchant Taylors' School, he became the leader of his class at that institution, and thus, in 1839, acquired a Junior Fellowship at St. John's College, Oxford, and was graduated four years afterwards as Double First, or with the highest rank both in the classical and the mathematical list. This success obtained for him a tutorship in the College, and his lectures upon logic soon made him famous in the University. In 1849 he published Aldrich's "Rudiments of Logic," with an Introduction and copious Notes, of which Sir William Hamilton observed that *la sauce vaut mieux que le poisson.* The work passed rapidly through three editions, and made its author known as one of the ablest and most learned logicians of the age. Two years afterwards appeared his *Prolegomena Logica,* which was based upon the philosophy of Kant, and contained the germs of all his subsequent speculations. It was reprinted in this country in 1860, from the second English edition, and has been a standard work in the

University course of instruction upon metaphysics on both sides of the Atlantic. In 1855, Mr. Mansel was appointed Waynflete Reader in Moral and Metaphysical Philosophy, and four years afterwards, when the recommendations of the University Commission took effect, he became Waynflete Professor. Dr. Stanley's appointment as Dean of Westminster having created a vacancy, Mr. Mansel was made Professor of Ecclesiastical History and a Canon of Christ Church; and in 1869, he succeeded Dr. Milman as Dean of St. Paul's.

In philosophy, Dean Mansel is commonly regarded both as a follower of Kant and as a disciple of Sir William Hamilton. This opinion does him great injustice, for though he adopts Kant's premises, it is for the avowed purpose of refuting Kant's conclusions; and he departs widely from Hamilton, both in his theory of Causation, and in his application of the Philosophy of the Conditioned to an exposure of the illogical character of theological rationalism and dogmatism. His modesty did not allow him to do justice to his own claims as an original thinker and a philosophical theologian. He seems not to have been ambitious to found a school, or to establish a new philosophical system. His aim was rather to rebuke the pretensions and expose the shallowness of those metaphysical infidels who have endeavored to reconstruct the doctrines either of Spinoza, Hume, or Hegel, for the avowed purpose of destroying the basis of all religious faith and hope. The ablest and most scholarly refutation of such pantheistic and atheistic speculations which the philosophy of the present age has furnished can be found in the several publications of Dean Mansel. Vehemently assailed as these have been by the enemies of conservatism in philosophy and theology, they have earned for their author a high place in the list which contains the honored names of Clarke, Cudworth, Butler, and Berkeley.

Charles Babbage was born in London, on the 26th of December, 1792, and, after a long life of nearly eighty years, died October 20, 1871. As a boy, his health was much weakened by violent fevers, and, accordingly, he was sent to school near Exeter, with instructions that much study should not be required of him. Here he early displayed the inquiring mind and ingenuity for which, in after life, he was so eminent. In 1811 he entered Cambridge, and graduated at the University in 1814. At this time the College was agitated by a fierce controversy, whether it was right to add notes to the Bible, each party forming societies and using every means to establish its views. Babbage parodied it by forming the Analytical Society to propagate the notation of Leibnitz, using the differential *d* in the calculus, and consigning to perdition all who supported the heresy of the *dots* of Newton. Being accused of infidelity, the members entitled the first volume of their transactions "The Principles of Pure D-ism in Opposition to the Dot-age of the University." They proposed to translate a small work of Lacroix on the Calculus, maintaining that it was so perfect that any comment was unnecessary.

In 1828, while in Rome, Babbage was elected Lucasian Professor of Mathematics at Cambridge; a chair first occupied by Sir Isaac Newton. After filling it for eleven years, he resigned, finding even the few duties it involved too much for his strength in addition to his other work. He bitterly calls it the only honor he ever received in his own country.

We now come to the great work of his life, and that by which he is best known to the public, namely, the construction of an engine for performing numerical computations. As early as 1813 he turned his attention to this matter. One evening, when sitting in the room of the Analytical Society, leaning his head on the table, another member, coming in, called out, "Well, Babbage, what are you dreaming about?" To which he replied, "I am thinking that all these tables (pointing to a table of logarithms) might be calculated by machinery." In 1822 he completed his first Difference Engine, which was capable of working two orders of differences, and computing six places of figures. It was highly approved by the Royal Society, and, in accordance with their recommendation, the government appropriated £1,500 for the construction of a large engine to compute eight orders of differences to sixteen places of figures. For four years the work was carried on uninterruptedly, but then various difficulties presented themselves. As it appeared that the cost would be much greater than was originally anticipated, the government was informed of the fact. More money was obtained; but, owing to the delay, the engineer who had entire charge of the construction withdrew, taking with him all the tools, the labor of years. A lawsuit ensued, but he was finally allowed to retain them. The work now went on at intervals, but finally a new idea occurred to Babbage of a machine whose powers should vastly exceed those of the Difference Engine. He called it the Analytical Engine, and it is difficult to describe, in a short notice like the present, the wonderful powers of this machine. It bore about the same relation to the other that algebra does to arithmetic, and, instead of merely computing arithmetical tables, it was designed to deal with all forms of analytical operations. Suppose we have any formula whatsoever from which we wish to compute a series of numerical values. Two sets of cards, like those of a Jacquard loom, are furnished the engine, the first to direct the nature of the operations to be performed, and the second to show which variables are to be acted upon. The numerical values of the constants being placed on the wheels, it would compute and print the results of the formula. If, during the operation, it wanted some other quantity, as the logarithm of a given number, it would ring a bell, and then stop. The attendant would find out what was wanted, and, procuring the logarithmic card, would place it in the machine. The latter would first see if it was correct, and, if not, would ring a louder bell and again stop. It would express every number it used to fifty places of figures, and would multiply two such numbers, giving a hundred places in the product, in about a minute. The complication of this instrument was such that it was impossible to represent it by ordinary drawings. Babbage, therefore, used a system of mechanical notation which he had devised, and without which he claimed that it could not have existed even upon paper.

In 1833, a portion of the Difference Engine was put together and worked admirably, computing tables with two or three orders of differences to sixteen places; but, unfortunately, the new invention seemed to supersede it, and finally, in 1842, the government, after spending £17,000 on the project, refused to give any further aid. Babbage now devoted his whole attention to the engrossing subject of the Analytical Engine, and succeeded so far that, with sufficient means, there seems to be little doubt that he would have attained all that he claimed.

His health suffered severely from the intense mental strain to which he was subjected in designing his engines, and, in consequence, he travelled a great deal both in England and on the Continent. As he seems to have availed himself of every opportunity to inspect in person any novelty he met with, we find him in many strange positions, and often narrowly escaping serious accidents. Thus, as a boy he was nearly drowned while testing a swimming-machine he had constructed. Again, in the Thames Tunnel, in company with Brunel, the water breaks in, and, but for the presence of mind of the latter, both would probably have been drowned. Later he descends in a diving-bell, in a coal mine is surrounded by explosive gases, enters the air-chamber of a blast furnace, also an oven for baking moulds at a temperature of 265° F., and finally descends the crater of Vesuvius between two eruptions which are taking place periodically at intervals of ten or fifteen minutes. In the early days of railroads he made many experiments on them; and one Sunday morning, when just about to start on an experimental train with thirty tons of pig-iron on board, narrowly escaped a collision with Brunel, who came down the line on an engine at the rate of fifty miles an hour.

He was elected a member of most of the principal scientific societies of the world, so that he was able to write after his name the titles, A. A. S., F. R. S., F. R. S. E., F. R. A. S., F. Stat. S., Hon. M. R. I. A., M. C. P. S., Inst. Imp. (Acad. Moral.) Paris Corr., Reg. Œcon. Boruss., Phys. Hist. Nat. Genev., Acad. Reg. Monac., Hafn, Massil., et Divion., Socius, Acad. Imp. et Reg. Petrop., Neap., Brux., Patav., Georg. Floren., Lyncei Rom., Mut., Philomath. Paris Soc. Corr., etc. His writings are somewhat voluminous. Among the most noted are the following. That "On a Method of Expressing by Signs the Action of Machinery" is a description of his Mechanical Notation. A good example of his talent for satire is a scathing criticism of the Royal Society, entitled "Reflections on the Decline of Science in England, and on some of its Causes." His most successful work was the "Economy of Manufactures and Machinery," which went through many editions, and was translated into German, French, Italian, and Spanish. To these must be added the "Ninth Bridgewater Treatise," and his autobiography, "Passages from the Life of a Philosopher."

As often happens with men of genius, when once interested in a subject he would devote his utmost powers to it, however trifling its importance; as, for instance, in reading ciphers, picking locks, and devising automata for playing games of skill. Or, again, when annoyed by street musicians, he displayed the same perseverance in prosecuting them as when urging the importance of his inventions on the government. As his engines have not been, and probably never will be, completed, many, doubtless, regard the life of Babbage as a failure. Yet in his own department he stood unequalled, and to him belongs the credit of devising the most complicated piece of machinery ever planned by the human mind.

Benoît Fourneyron was born October 31, 1802, at St. Etienne, France. He studied in the School of Mines of his native city, and began his career as a mining engineer in the mines of Creuzot. His attention was soon turned to water-wheels, and his experiments for improving horizontal water-wheels are said to have been begun as early as 1823. In 1827 his first turbine, constructed on the new principle of putting a cylindrical wheel with curved floats outside of a fixed cylinder containing curved guides, was set up at Pont sur l'Ognon. It was of six-horse power, and its efficiency was rated at eighty per cent. A second wheel of seven or eight horse power was erected in 1831 at Dampierre, and a third, of fifty-horse power, in 1832, at Fraisans. The success of this invention was so marked, that a prize of 6,000 francs, offered by the Society for the Encouragement of National Industry, for the best application to mills and manufactories of the hydraulic turbines of Bélidor, was awarded to Fourneyron in 1834. These wheels were soon introduced in various parts of France and Germany. One in the Black Forest worked under a fall of 354 feet. Gold medals were awarded to Fourneyron at the Industrial Expositions of 1839 and 1855, and a medal of honor at that of 1867. Fourneyron was Chief of Battalion of the National Guards in 1847, and in 1848 represented the Department of the Loire in the Constituent Assembly. He published papers on turbines, and on several other engineering subjects, in the Bulletin of the Industrial Society of Mulhouse for 1831, in the Bulletin of the Paris Society for the Encouragement of National Industry for 1834, and in the *Comptes Rendus* for 1836, 1837, 1840, 1841, 1843, and 1852. A treatise on turbines was published by him at Liege in 1841, and a table on the flow of water in pipes in 1844. He was elected a Foreign Honorary Member of this Academy, November 13, 1849. He died in Paris, July 8, 1867.

Hugo von Mohl, the acknowledged chief of the vegetable anatomists of this generation, died on the first day of April last. He was born at Stuttgard, April 8, 1805, the youngest of four brothers who all became men of mark in political and scientific life; Julius the orientalist and Hugo the botanist being the most distinguished. The latter was educated at the Stuttgard Gymnasium and Tübingen University, where he studied medicine as well as natural history and physics. His first publication, while a student, in the year 1827, was his Essay on the Structure and Soiling of Tendrils and Twiners, written in response to a prize-question offered by the Tübingen Medical Faculty. In it he divined the real nature of the movements which coiling stems and tendrils execute, as has recently been clearly made out. In the following year appeared his inaugural dissertation on the Pores of the Cellular Tissue of Plants, in which his later views and discoveries, respecting the structure, growth, and component parts of cells, as subsequently developed, are already foreshadowed. About this time his choice was made for a scientific rather than a medical career; and he went to Munich to prosecute more advantageously his favorite studies. Here the late Von Martius and Zuccarini were his botanical masters, and Agassiz, Karl Schimper, Braun, and Engelmann his fellow-students. Here he made those researches upon the anatomy of ferns, cycads, and especially of palms, — the latter a most important contribution to Martius's great work upon palms, the former also contributed to another work by Martius, — which first displayed his remarkable talents for histological investigation, to which his subsequent scientific life was mainly devoted. His merits were promptly recognized by a call to the Imperial Botanic Garden of St. Petersburg, as assistant to its director, Dr. Fischer, and to the chair of physiology in the Academy of Berne. He accepted the latter in 1832, and occupied it until 1835. Then, upon the death of Schübler, he returned to Tübingen, accepted the professorship of botany in its High School, in which chair and in that of Tübingen University the rest of his life was passed. Invitations to more prominent and lucrative positions, as, for example, to the botanical chair at Berlin University when vacated by the death of the veteran Link, were unhesitatingly declined. Although he published numerous (about ninety) special papers or articles, most of them important and timely, and some of great pith and moment, he resolutely declined to bring out any general work. His *Mikrographie* (1846) and his "Principles of the Anatomy and Physiology of the Vegetable Cell" are his only writings which may claim to be such. The latter, an admirable and still invaluable treatise, appeared as an article in Rudolf Wagner's Cyclopædia of Physiology, but is best known to English readers in its separate form, in a translation made by the late Professor Henfrey, with the author's sanction, issued by Van Voorst in 1852. A year or two later it was for a time understood, to the great satisfaction of botanists, that Mohl had agreëd to take a prominent part in the production of a general Manual of the Anatomy and Physiology of Plants; but his promise was soon withdrawn. For thirty years he was one of the editors of the *Botanische Zeitung;* but the editorial labor must have devolved mainly upon Schlechtendal and his successor, although occasional articles from Mohl's pen appeared as late as the year 1871. During that year his health became seriously impaired; yet, as the new year advanced, apprehension disappeared. Upon Easter Monday he was apparently well, and so retired to nightly rest: in the morning he was found to have died in sleep.

JOHN F. W. HERSCHEL was born on March 7, 1792, and died on May 11, 1871, having nearly approached the advanced age of four-score of years. If there is any single spot on earth more memorable than all others in the history of astronomy, it is the observatory of William Herschel, the father, at Slough. Discoveries more and greater than have ever been made elsewhere have given to this little village a fame which will keep alive that of Windsor Castle, as the king, George III., wisely calculated when he placed the astronomer near him with a pension. Of this genius of the observatory, educated, like all of his nine brothers and sisters, to be a musician, it was said that he "had reached the middle of his course before his career of discovery began, and it was in the autumn and winter of his days that he reaped the full harvest of his glory." Here, at Slough, the father incessantly watched the stars for forty years, with a natural vision above that of ordinary mortals, assisted by optical contrivances of his own invention, which are scarcely surpassed by those of the generations which have entered into his labors. Here, also, was the home of Caroline L. Herschel, herself no ordinary astronomer, who left the world of science in doubt which most to admire, "the intellectual power of the brother, or the unconquerable industry of the sister." From this spot William Herschel sent to the Royal Society, in rapid succession, sixty-seven memoirs, richly freighted with his own glorious discoveries, which were the safe ballast by which he kept his mind from growing giddy with his bold speculations on the structure of the universal heavens. On this spot were discovered the satellites of the new planet, Uranus, and two additional satellites of the old planet, Saturn; on this spot was showered for the first time, in visible forms, the light of hundreds of nebulæ, and here was first dissected the blended lustre of more than five hundred double stars. Here were garnered up the proofs that the sun was not a fixed point about which the planets revolved, but that it was sent, in their company, on a mission of its own from star to star and from constellation to constellation, the full import of which cannot even now be more than surmised. The magnificent and almost solitary career of the elder Herschel is thus described by the late Sir David Brewster: "The springtide of knowledge, which was thus let in upon the human mind, continued for a while to spread its waves over Europe; but when it sank to its ebb in England, there was no other bark left upon the strand but that of the Deucalion of Science, whose home had been so long upon its waters."

On such a spot as this, and into such a home as this, the young Herschel was born. There are, no doubt, those, and not a few, on whom such high companionship, such inspiring examples, would have been wasted. There are in science, as well as in literature and all the other walks of life, examples enough of degenerate sons placed in saddest contrast with an illustrious ancestry. Happily for science, John Herschel was not of this class. His great career, as well as the few glimpses he has permitted the world to have into his early life, gives us the assurance that none of that untiring devotion to science, of those midnight watches among the stars, or of that incessant labor by day, which have made the name of Herschel a household word in all lands, was lost upon his young mind and heart. It was not in vain that the aroma of Science perfumed his cradle and his early childhood. By it, no doubt, he was won to lovingly enter her service and prepare himself to receive the mantle when it fell from the shoulders of his aged father. No microscopic autobiography has distinctly revealed to us the reality of what we can easily suspect. But the obituary notices of the Royal Astronomical Society inform us that John Herschel himself, in a few rare instances, has lifted the veil which obstructs our view by reporting the dialogues which he had with his father. These hints justify our inference that the boy, at an early age, was charged to reflect as well as to hear, and to see as well as to look.

Until Herschel entered St. John's College in the University of Cambridge, for which he was fitted at the early age of seventeen, his education was received chiefly at home, with private tutors. For, after a short trial at Eton, he was removed from that school in consequence of the abuse he endured from a stronger boy, the nature of which we do not know; but perhaps here it would be called *hazing*. At the University, he mastered Newton's *Principia*, and graduated as senior wrangler, the eminent mathematician, Professor George Peacock, being second on the list. If it be true, as has been pithily said, that God always works by geometry, the course which Herschel preferred at Cambridge was the best preparation he could have made for his great scientific career. And here again, doubtless, he owed something to a father's example. The world has been so dazzled by the brilliant results of Sir William Herschel's incomparable powers of vision, his bold scientific imagination, and his magnificent instruments, as not to see that he had also been a musician who entranced fashionable audiences in the theatre and concert-room and in oratorios, and that he studied algebra and geometry in order that he might master Robert Smith's "Harmonics, or the Philosophy of Musical Sounds." Arago has recalled from oblivion the fact that in 1779 Herschel gave the solution to a difficult problem on the vibrations of a loaded cord, which may be seen in Leybourn's edition of the "Ladies' Mathematical Diary." The younger Herschel, in the eulogy which he pronounced upon his worthy compeer, Francis Baily, makes this confession in regard to the state of science in England at the beginning of the present century: "Mathematics were at the last gasp, and astronomy nearly so." The ponderous notation of fluxions, which required the giant arm of a Newton to wield successfully, was retained at the English universities after science had outgrown it, and the finer methods of the Continental mathematicians were ignored. Herschel did his part, as student and graduate, to inaugurate the revolution which finally culminated in such mathematicians as Hamilton and MacCullagh, Sylvester and Gregory, Boole and Cayley, Tait, Adams, Airy, and Thompson. The president of the British Association in 1871 (a most competent witness) said: "In respect to pure mathematics, Sir John Herschel did more, I believe, than any other man, to introduce into England the powerful methods and the valuable notation of modern analysis." Herschel was one of the first to recognize the value of Hamilton's quaternions, which he described as a "Cornucopia from which, turn it how you will, something valuable is sure to fall." If Herschel had devoted his life to the development of the pure mathematics, as he seemed at first inclined to do, he might have taken rank with the highest in that field of investigation. His earliest publications were upon this subject, and he frequently returned to his first love, as late even as 1850. There is no occasion to regret that a mind of a high order, and thoroughly imbued with the mathematical spirit, should have been transplanted into the domains of geology, chemistry, physics, and astronomy, for there were fields there already white and waiting for a harvest, and only a mathematician could be the reaper. All of these sciences aspire to that high estate which some have already reached, when theories stand or fall according to the quantity as well as the quality of the forces which they furnish for the explanation of phenomena, — quantities which the highest mathematics are often inadequate to calculate.

Herschel moved from Cambridge to London, and began the study of Law. But the new acquaintance which he formed with Wollaston, the microscopic philosopher, as he has been called, soon turned his attention to Chemistry and Optics. His first publication in chemistry, on hyposulphurous acid, contained an important discovery, and was followed, at various intervals, by others, — on photography, on the chemical influence of light, on the action of light on precipitation, and on its effect upon vegetable colors. His investigations in Optics began at as early a date, and were not wholly relinquished until 1863. He applied the theory of diffraction to the explanation of the beautiful colors of mother-of-pearl; calculated the colored curves, called *lemniscates*, produced by the passage of polarized light through biaxial crystals; investigated Newton's *tints;* studied the aberration of lenses, the absorption of light by colored media, the light emitted by lime, the mineralogical import of *right-handed* and *left-handed* circular polarization in quartz, the irregularities of the colored rings in apophillite, the insensibility of some eyes to certain colors; discussed the merits of a fluid lens for the telescope; examined the coloring matter in certain green sands; suggested improvements in the Argand lamp; added the *lavender* tint to the solar spectrum; and finally, by his announcement of *epipolic dispersion* as exhibited on the surface of sulphate of quinine, furnished Stokes with the key to his important discovery of the change which luminous waves may suffer in their period of oscillation.

Notwithstanding the numerous successes which Herschel achieved as mathematician, chemist, and physicist, and the still greater triumphs in these directions of which he gave promise, he was destined by circumstances, if not by preference, to be an astronomer. The Royal Astronomical Society of London was founded in 1820, with William Herschel as its first President, and John Herschel as its first Foreign Secretary, and in the thirty-eight volumes of valuable memoirs which it has published, no other name shines so brightly as that of Herschel. If the illustrious F. G. W. Struve was animated, as he confesses, by the great example of William Herschel, to undertake his vast labor on the *Double Stars*, it is not strange that the younger Herschel should have been ambitious of reaffirming the discoveries of his father in the northern hemisphere, and of completing them by an independent survey of the southern stars and nebulæ. For this purpose, he was first associated with Sir James South, an amateur astronomer of immense zeal and ample means. The union was a happy one for both, and for astronomy, inasmuch as it placed at Herschel's disposal instruments of the first class, and secured to the work which had been undertaken the advantage of a highly gifted and well-trained mind. While this partnership lasted, observations and measurements were made on 380 double or triple stars, and promptly published.

Soon after this, we find Herschel established in the spot of greatest interest to all astronomers, and to him above all others, namely, in the old observatory at Slough. Provided with a reflecting telescope of 18 inches aperture, in the construction of which he had the advice of his father, he began to sweep the sky for double stars and nebulæ, as his father had done before him, and with equal success, though he missed the valuable assistance which his father had enjoyed in Miss Caroline L. Herschel. In spite of this disadvantage, and without the mechanical appliances which Struve enjoyed, and the still greater conveniences which both would have found in the chronographic method of recent times, catalogue after catalogue of double stars, clusters, and nebulæ, many of which had escaped the piercing eye of the father, poured into the volumes of the Royal Society and the Astronomical Society, and Slough became once more a centre of intense intellectual activity. Herschel was now more than forty years old. And if he had been less ambitious, or less courageous, or less devoted to astronomy, he might have been content with the laurels already won. But he knew that there was a new world of astronomy to be conquered in the southern hemisphere, — a zone of more than fifty degrees encircling the south pole, no star of which could ever shine in his telescope at Slough, however penetrating. Now and then an astronomer, like La Caille, had been despatched thither for a specific purpose and for a brief residence, and observatories, more or less permanent, had been established at the Cape of Good Hope and at Paramatta; but no one, before Herschel, had dreamed of making an exhaustive survey of those strange skies, of which the eloquent pen of Humboldt had depicted, and possibly exaggerated, the beauties. The motives and the object of Herschel in banishing himself, with his family and assistants, for four years, to the Cape of Good Hope, are best described in his own words. After alluding to what he and his father had done at Slough, he continues: "Having so far succeeded to my wish (the places of the objects thus determined proving, on the whole, satisfactory), and having by this practice acquired sufficient mastery of the instrument employed (a reflecting telescope of 14¼ inches clear aperture and 20 feet focus on my father's construction), and of the delicate process of polishing the specula; being, moreover, strongly invited by the peculiar interest of the subject, and the wonderful nature of the objects which presented themselves in the course of its prosecution, I resolved to attempt the completion of a survey of the whole surface of the heavens, and, for this purpose, to transport into the other hemisphere the same instrument which had been employed in this, so as to give a unity to the results of both portions of the survey, and to render them comparable with each other."

Herschel sailed from England on November 13, 1833, with his family and instruments; and on his arrival at the Cape, January 15, 1834, he selected, as the site of his temporary observatory, Feldhausen, situated a little to the southwest of the Royal Observatory of the Cape. In a month his instruments were placed in position and ready for work. After luxuriating for a few nights, with laudable curiosity, on some extraordinary objects in the constellation of the Cross and of Argo, he began his regular *sweeps* of the southern sky on the 5th of March. When he had left the Cape, a granite monument was erected by friends, to commemorate the charming spot, at the base of Table Mountain, where his observatory stood. Few astronomers will have the privilege of seeing it. But they have the greater privilege of beholding always the nobler monument to the family name of Herschel, in the magnificent quarto volume, of nearly five hundred pages, illustrated with seventeen plates, which bears the august title, "Results of Astronomical Observations made during the years 1834, 5, 6, 7, 8, at the Cape of Good Hope; being the completion of a telescopic survey of the whole surface of the visible heavens, commenced in 1825," and dedicated to the late Hugh, Duke of Northumberland, by whose munificence the work was published.

A bare enumeration of the subjects of the seven chapters of this volume will give some idea of the variety and severity of the labor crowded into Herschel's few years of residence at the Cape. Chapter I. records that which energized the whole enterprise, namely, the registration of the nebulæ and clusters of the southern sky. Of these, 1708 are registered, most of them new to astronomy. Others, not wholly invisible in the northern observatories, were carefully re-examined by Herschel from his more favorable point of view. The Magellanic Clouds, that miscellaneous collection of individual objects in strange companionship, were dissected, and found to be composed, the one of 919 and the other of 244 distinct stars, nebulæ, and clusters. Chapter II. tells us that his catalogue of double stars, which had reached 3346 in the northern hemisphere, had grown by his southern contributions to 5542. Chapter III. marks the indomitable perseverance of the astronomer, who found relief from severer toil in determining the relative brightnesses of many of the southern stars. Neither did Herschel omit, as we learn from Chapter IV., to apply to the southern stars and the southern galaxy the system of gauging, instituted by his father, to discover the comparative *populousness* of the sky in different spots; on which, as upon a scientific basis, and not, as others had done before him, by mere speculation, he ventured an outlook into the structure of the universe. Probably an astronomer less zealous than Herschel would not have allowed the opportunity to slip of observing a comet as remarkable as Halley's, at its last appearance in 1835. But as we turn over the pages of Chapter V. of the *Results*, and rehearse the numerous observations therein recorded, and examine the admirable delineations of the changing phases of the comet, comparable in excellence with those which Schwabe and Bessel made in Europe, and ponder upon Herschel's weighty discussion of the physical condition of comets (better revealed by this comet than by any other except Donati's), we cannot but congratulate science on the well-timed visit of comet and astronomer. The two remaining chapters record observations on the satellites of Saturn and the solar spots. No one knew better than Herschel the need of new evidence for computing the orbits, or even verifying the existence, of these remote satellites; and the course of recent investigations into solar influences has given an importance to all good observations on the sun's spots greater than any one could have anticipated. Herschel realized, no doubt, that the new views of the celestial scenery which he had enjoyed, the intellectual gratification which he had received from his discoveries, and the filial duty that he had discharged to astronomy, were an over-payment for whatever he had sacrificed by a self-imposed banishment from his native land. Nevertheless, he had given to astronomers a bright example of the victory which a passion for truth may gain over present comfort and social enjoyment, and an example which others have been ambitious to imitate. His return to England was, therefore, as it deserved to be, an ovation.

If what Herschel did at Slough and at the Cape of Good Hope was the greatest work of his life, it by no means fills out the measure of his services even to astronomy. Among his miscellaneous contributions to scientific journals and transactions we find such subjects as these : Occultation of the Stars ; Determination of Differences of Geographical Longitude ; Parallax of the Fixed Stars ; Orbits of Binary Stars ; Biela's Comet and the great Comet of 1843 ; Revision of the Constellations ; Satellites of Uranus ; Variability of Stars ; Test Objects for Telescopes ; Entrance Passages into the Pyramids of Gizeh ; and upon each and all might be inscribed, *Non tetigit quod non ornavit.*

Astronomy has done much for geography, and it promises to do more for geology, whenever the geologist shall have a moderate knowledge of astronomy, or the astronomer interest himself in the wonders of geology. Of various contributions which Herschel made to geology, two may be particularized. 1. He discussed with Lyell the effect which the position of the major axis of the earth's orbit might have on the comparative climates of the northern and southern hemispheres. 2. The startling and irregular changes in one of the stars of the constellation Argo, some of which came under his own inspection, suggested to Herschel reflections on the possible fluctuations in solar heat, and the consequent vicissitudes in the earth's history, which are worthy of the attention of every thoughtful geologist. Moreover, the scientific powers of Herschel were not confined to mathematics, chemistry, astronomy, and geology, for occasionally he made excursions into the domains of meteorology, magnetism, electricity, and general physics.

However broad the field over which Herschel travelled as an original investigator, he still found time to write elaborate treatises on special subjects. In the *Encyclopædia Metropolitana*, he has handled the subjects of Light and Sound in a masterly way. His contributions to this work were published forty years ago, but nothing has been written since in the English language that will supply their place, although the treatise on Sound requires now numerous additions to bring it up to the present state of the science of acoustics. The treatise on Light is rich in illustrations, experimental, mathematical, and historical, and contains an impartial presentation of the merits of the corpuscular and undulatory theories of light, and of the great services of Newton, Huyghens, Young, and Fresnel. The English reader owes especial regard to Herschel for his first introduction to Fresnel, the mathematical expounder of the undulatory theory of light; his scattered and tardily published writings having been first gathered and printed in an easily accessible form as recently as 1866. We have to thank the German and French translators for rescuing this treatise of Herschel on Light from the bulky and unwieldy volumes of the Encyclopædia, and printing it in a separate and convenient form. Herschel wrote two volumes for the Cabinet Cyclopædia of Dr. Lardner. "The Preliminary Discourse on the Study of Natural Philosophy" brought him into notice before a larger public as a writer and a philosopher. The objects and the methods of science, the meaning of natural law, and, of course, the analysis of phenomena and the process of generalization, the utility, dignity, and pleasures of science, are elegantly stated and vividly illustrated. This discourse was translated into German. The treatise on Astronomy, first published in the Cyclopædia in 1833 (and also translated into German), was expanded in 1849 into the "Outlines of Astronomy," which has run through ten editions. In this work, Herschel has handled skilfully the subject of planetary perturbations, without the use of the higher mathematics, and has given to the general reader imperfect glimpses of what must otherwise have been a sealed book to him; and everywhere the language is as grand as the themes of which it treats. In 1859 the "Outlines" was translated into Chinese.

Herschel did not disdain the task of writing for the people as well as for men of science. Three articles which he furnished to the *Encyclopædia Britannica*, on Meteorology, on Physical Geography, and on the Telescope, have been republished in separate volumes. After reaching the advanced age of threescore years and ten, he delivered a few lectures to a village audience, and then printed them, with other similar productions, in "Good Words." In 1868, they were collected into a small volume, with the title "Familiar Lectures on Scientific Subjects." But this must have been the amusement of his leisure hours, if it is possible to suppose that a man who did constantly so much heavy work had any leisure. How he refreshed himself after the midnight watches at the observatory, or amid the sterner labors of his study, all may know who will examine the volume issued in 1857 with the title, "Essays from the Edinburgh and Quarterly Reviews, with Addresses and other Pieces." These other pieces were poems, original or translated, while the Reviews and Addresses were upon the loftiest themes in science and philosophy, and abound in passages of magnificent diction, profound thought, and sublime eloquence.

The last years of Herschel's life, when he seemed to have retired from active service, were enriched with the fruits of his intellect and imagination. He is still poet, philosopher, mathematician, physicist, and astronomer, to his latest hour. Though his translation of the Iliad of Homer may give him a place as a classical scholar by the side of Pope, Blackie, Dart, Lord Derby, or our own Bryant, we can fancy the happiest moments of his life to have been when, in 1864, after having tardily published the seventh catalogue of observations at Slough, he gave to the world his one hundred and thirty-fourth scientific paper, namely, a highly elaborated catalogue of the five thousand and seventy-nine nebulæ which had been observed by his father, himself, or any other astronomer: or again when, undaunted by the growing infirmities of age, he labored at the stupendous task of framing a universal catalogue, with descriptions, of the ten thousand double stars hitherto registered, bequeathing the manuscript to loving hands, so as to secure its speedy completion and publication.

We may not forget the services which Herschel rendered to his country as Master of the Mint for five years, as President of the Royal Astronomical Society, and of the British Association for the Advancement of Science, or by the Instructions which he edited for the Board of Admiralty as a Manual of Scientific Inquiry, and to which he contributed his quota. We may also allude to the reports he made in behalf of the Magnetic and Meteorological Observatories established throughout the British Empire, and his efforts to establish a uniform standard of length. Fired by the example of Humboldt, he kindled his own country into a like enthusiasm in the study of Terrestrial Magnetism, which he watched and guided for twenty years, nerving his coworkers to undertake a first, second, and even third, magnetic crusade.

The tendency, and almost the necessity, of modern scientific study is strongly in favor of an exclusive devotion to some narrow specialty. Dissipation of energy is conditioned on superficiality, and the universal genius is regarded with suspicion. Nevertheless, the example of Herschel is an exhortation and an encouragement to the most liberal culture, by showing how many things can be done, and done well, when length of days, indomitable industry, and good natural endowments are united. It is to the credit of humanity and of science that the merits of Herschel were felt in every home, and met with all that public recognition and honor which academies and societies are able to bestow. It is a pleasant thought that this great and successful man of science had no scientific quarrels to embitter his life, that his character was beyond reproach, that his cup of domestic joy was full, and that everywhere he was loved as much as he was admired. Happily, too, he has left successors to his fame as well as to his name, who may be worthy to wear the mantle which two generations have made resplendent.

Sir William Thompson, in his address before the British Association, said: "A monument to Faraday and a monument to Herschel Britain must have. The nation will not be satisfied with anything, however splendid, done by private subscription." Whatever other monument Herschel may have, let that most appropriate one be forever guarded and preserved, which he himself chose in honoring his father, when, on January 1, 1840, he, and his wife, and children, and servants, assembled around the dismantled and prostrate telescope which had astonished the world, sang a requiem, which he composed, inside of the tube, and then hermetically sealed it.

Moses Ashley Curtis was born in Stockbridge, Massachusetts, on the 11th of May, 1808. His father was the Rev. Jared Curtis, of Stockbridge, afterwards for many years chaplain of the State Prison at Charlestown. His mother was a daughter of General Moses Ashley. He was fitted for college chiefly under his father's tuition, and was graduated at Williams in the class of 1827. Three years afterward, he went to Wilmington, North Carolina, as a tutor in the family of Governor Dudley, while at the same time he studied divinity. There he resided until the year 1841, with the exception of a year and a half passed with his father in Charlestown. In the autumn of 1834, he married Miss De Rosset, of Wilmington, who survives him. He took holy orders at Richmond, Virginia, in the summer of 1835; became rector of the Protestant Episcopal Church at Hillsborough, North Carolina, in 1841, and fulfilled the duties of this station for the remainder of his life, with the exception of ten years, from 1847 to 1857, during which he had the pastoral charge of a parish at Society Hill, South Carolina. The degree of Doctor of Divinity was conferred on him by the University of North Carolina, at Chapel Hill. His health for a few years past was sensibly impaired; but he was able to perform his professional duties, and, in a measure, to prosecute his scientific studies, until the 10th of April last, when he died suddenly, probably of heart disease.

Dr. Curtis's attention must have early been attracted to botany, and his predilection fixed by his residence at Wilmington, one of the richest and most remarkable botanical stations in the United States. For it was in the year 1834, after only three years' residence there, that he communicated to the Boston Society of Natural History his first botanical work, namely, his "Enumeration of Plants growing spontaneously around Wilmington, North Carolina, with Remarks on some New and Obscure Species." This was printed in the first volume and second number of that Society's Journal; but the original impression having been mainly destroyed by fire, important additions and emendations were made in the subsequent reprint. The author's powers of observation and aptitude for research are well shown in this publication, and it is one of the earliest of the kind in this country in which the names of the genera and species are accented. In his note upon the structure of Dionæa, or Venus's Fly-trap, — a plant found only in the district around Wilmington, — Dr. Curtis corrected the account of the mode of its wonderful action which had prevailed since the time of Linnæus, and confirmed the statement and inferences of the first scientific describer, Ellis, namely, that this plant not only captures insects, but consumes them, enveloping them in a mucilaginous fluid which appears to act as a solvent. Extending his botanical observations to the western borders of his adopted State, Dr. Curtis was among the first to retrace the steps and rediscover the plants found and published by the elder Michaux, in the higher Alleghany Mountains. But for the last twenty-five years, his scientific studies were mainly given to mycology, in which he became a proficient and the highest American authority. His papers upon Fungi, some of which are large, and all important, were mainly published by the American Philosophical Society, and by the Linnean Society of London. Several of them are the joint productions of Dr. Curtis and of the able English mycologist, Mr. Berkeley. His other published writings mainly are "A Commentary on the Natural History of Dr. Hawks's 'History of North Carolina,'" — a good specimen of his appreciation of exact research, and sharpness of wit wholly free of acerbity; two papers in "Silliman's Journal" on "New and Rare Plants of the Carolinas"; and the botanical portion of the "Geological and Natural History Survey of North Carolina," in two parts; — the first, a popular account of the trees and shrubs, issued in 1860; the other, a catalogue of all the plants of the State, in 1867. This includes the lower Cryptogamia, especially the Fungi, of which he enumerates almost 2,400 species, while the Phænogamous plants are less than 1,900. All our associate's work was marked by ability and conscientiousness. With a just appreciation both of the needs of the science and of what he could best do under the circumstances, when he had exhausted the limited field in Phænogamous Botany within his reach he entered upon the inexhaustible ground of Mycology, which had been neglected in this country since the time of Schweinitz. In this difficult department he investigated and published a large number of new species, as well as determined the old ones, and amassed an ample collection, the preservation of which is most important, comprising as it does the specimens, drawings, and original notes which are to authenticate his work. By his unremitting and well-directed labors, filling the intervals of an honored and faithful professional life, he has richly earned the gratitude of the present and ensuing generations of botanists. Several years ago he prepared drawings of the edible Fungi of the country, with a view to making them better known in an accessible and popular publication; but he was unable to find a publisher. He was much impressed with their importance as a source of food. During the hardships of the Rebellion, he turned his knowledge of them to useful account for his family and neighborhood; and he declared that he could have supported a regiment upon excellent and delicious food which was wasting in the fields and woods around him.

JOHN EDWARDS HOLBROOK was born in Beaufort, South Carolina, on the 31st of December, 1796. He spent his childhood in Wrentham, Massachusetts, the home of his father. He graduated at Brown University, subsequently studied medicine in Philadelphia, and completed his scientific education at the Medical School of Edinburgh. He travelled extensively on the Continent, making himself thoroughly familiar with everything pertaining to his profession. In 1822, he returned to America, and established himself in Charleston, where he was appointed to the Professorship of Anatomy in the Medical School; — a post he occupied for over thirty years. In 1827, he married Miss Harriet Rutledge, who assisted and encouraged him in all his scientific pursuits. Her remarkable social and intellectual qualities endeared her to a large circle of friends, who will ever gratefully remember the hospitalities of Belmont and the kindness of the host and hostess.

In the midst of his professional duties he found time to devote to investigations of Natural History, his volumes on the "Herpetology of the United States" being perhaps one of the first publications to attract the attention of European scientific men to the progress of the natural sciences in the United States. The naturalists of the present day cannot be too grateful to him for having produced a work which at the time not only had no equal in Europe in its special department, but will remain hereafter the standard work, and the basis for all subsequent works on the subject in this country; although at the time of its publication the difficulties which beset an author, in the way of want of libraries, total absence of scientific tradition, and lack of accurately determined material, can hardly be appreciated by the naturalists of the present time, with their daily increasing facilities for study and comparison. These difficulties only a true love of his science could have surmounted; and the example given by Dr. Holbrook will long be beneficially felt throughout the country.

After the completion of his "Herpetology" he visited Europe again, and renewed the relations he had formed before with the scientific men abroad, more especially with the professors of the *Jardin des Plantes.*

On the breaking out of the war, he was engaged upon his "Ichthyology of South Carolina," for which the State of South Carolina had given him a moderate grant to defray a part of the expenses. The first edition was nearly completely destroyed by a fire in Philadelphia, and the war put an end to all further work. It is thus unfortunately left incomplete. During the war he served as a physician in the Southern army, and in spite of his old age was often compelled to share the rations and be exposed to the hardships of the common soldier. At the close of the struggle he was among the first who were willing to make all reasonable concessions for the restoration of peace, and who returned with unimpaired affection to his Northern friends, although the result had involved him in the common ruin.

For the last years of his life he spent the summers in New England. He died on the 8th of September, 1871, at Norfolk, Massachusetts, at his sister's residence, in the village where he had spent his infancy and boyhood, surrounded by his family and friends.

DENNIS HART MAHAN was born April 2, 1802, in the city of New York. His boyhood was passed in Norfolk, Virginia. While pursuing the study of medicine with Dr. Archer, in Richmond, Virginia, he received in 1820, through the influence of Hon. Thomas Newton, of the United States House of Representatives, an appointment as cadet at the United States Military Academy. Entering the Academy at the age of eighteen, he at once became the marked man of his class, and took the foremost rank. While only a third-classman, he was appointed acting assistant professor of mathematics On July 1, 1824, he graduated at the head of his class, and entered the corps of engineers of the army. He continued attached to this corps, with the rank of second lieutenant of engineers, until January 1, 1832, but saw no actual service, being always on detached duty. From 1824 to 1826, he was serving at the Military Academy; the first year, as assistant professor of mathematics, the second, as principal assistant professor of engineering. The next four years, from August, 1826, to June, 1830, were spent in Europe, on professional duty, by order of the War Department. During the last year of this sojourn in Europe, he was, by authority of the French Minister of War, attached as a pupil to the military school of artillerists and engineers at Metz. At that time there was no other place or school which could give that special training which so thoroughly fitted him for the duties to which he was to be called immediately upon his return to his own country. Metz, with all the glories of its historic renown as the bulwark of France, was also the thorough exemplification of the best systems of fortification devised by the genius of Vauban and Cormontaigne; and here, if anywhere, the earnest student would become thoroughly impressed with the love of his art, and initiated into all its mysteries. Mahan, on his return home, was at once appointed acting professor of engineering at the Military Academy, and finally, in 1832, was appointed professor, — a post which he filled with distinguished honor until his death on the 16th September, 1871.

In order to appreciate the full influence of his character and attainments in this position, we must go back to the period when he assumed its duties, and see what was the state of engineering science at the time. The student of the present day will find it hard to realize what the actual state of knowledge then was. Professional books were rare, and hardly existed except in foreign languages; and the number of those who had the desire and ability to consult them was still rarer. Military engineering was a meagre conglomeration of a few detached practices rather than principles; and civil engineering, not having yet received the impetus which the railroad system has since given it, could hardly be said to have an existence as a science. It became necessary for Mahan to create his own text-books; and even as late as 1842, when the writer was a pupil under him, these text-books were, in many cases, lithographic notes prepared at the presses of the Academy, and lent to the students for their instruction. The whole subject of permanent fortification and stereotomy was thus taught, and there were no American books upon the subject existing at that time. Even in the more elementary descriptive geometry the only American book was by a professor at the Military Academy, and this omits entirely the "*Théorie des plans côtés,* which forms the basis of fortification drawing.

But Mahan was one of those rare men who teach more by their personality than by their books. While it is true that he created books, and books which, though pioneers in their day, stand the test of comparison with the best works of later explorers, it is equally true that those who were so fortunate as to sit under his instruction learned much more than the books ever revealed. In the magic power of his personal communication with the pupil lay the great secret of his success as a teacher. The pupil who came under his searching eye felt that all shams were useless, that anything like pretension was at once exposed and rebuked, while true, honest effort always met with a cordial and hearty response, and found all the aids which it sought. The writer had the privilege of being not only his pupil, but, at a later period, his principal assistant; and in this latter capacity he learned to know the value of this great teacher. With a nature peculiarly sensitive, and a very nervous organization, Mahan had so schooled himself that he had become truly judicial in his estimate of whatever was presented to him. With a genuine love of science in any of its developments, he had naturally that instinctive abhorrence of charlatanry in its multiform manifestations, and that unsparing sarcasm ever ready for its exhibition, which led those who did not know him to regard him as cynical and morose. But none who had the honor of his friendship ever looked at him in this guise. To them he was the true, warm-hearted friend, to whose ready sympathy in everything that was right and honest they would appeal without hesitation; but whom, on the contrary, they would dread to approach with any proposition of doubtful or even questionable probity. Though small of stature and thin of frame, Mahan had ever a commanding presence, before which presumption and arrogance felt rebuked; and this personality made itself felt by even the most turbulent spirits in his classes. His effect in this way, even upon those who were not qualified to directly appreciate his instruction, made no small part of his influence as a professor in our Military Academy.

But Mahan's influence and the value of his life are not confined to the immediate scene of his labors. By his occasional writings, and by those of his published works which are less distinctly professional, he has stimulated the public mind in a much wider sphere. His work on civil engineering, which has gone through several editions, and been several times revised and almost rewritten by its author since its first publication, is still one of the best compendiums on the subject. His edition of Moseley's "Mechanics of Engineering," with its valuable additions and annotations, has brought to the notice of the American public one of the very best English works. During our late war, his work on field fortifications — the best work on that subject in any language — and his minor work on outpost duty were in the hands of all of our militia officers who sought instruction in their duties. Science and education owe much to the labors of his long life, and the memory of that life will be preserved in the many works which he has left behind him. Brown and Princeton conferred upon him the honorary degree of A. M. in 1837, and he subsequently received that of LL. D. from William and Mary, Brown, and Dartmouth. In 1828, he was elected a member of the Geographical Society of France. He was a member of several scientific societies in this country, and one of the original fifty corporators of the National Academy of Science.

To the interests of the Military Academy Mahan devoted the best energies of his life. Regarding it not merely as a school of military science, but as it really was, for a long period, the only scientific school worthy of the name in our country, his whole thoughts were given to the advancement of its prosperity; and, as one of its Faculty, he jealously watched every change in its educational system which tended to lower its high standard. Especially, in all the assaults which are periodically made upon it, was he found ever ready, by voice and pen, to repel those assaults, and vindicate the fair reputation of his Alma Mater. No one could do this better than he. With a thorough conviction of the honesty of his cause, and a mind well stored with historical knowledge, he combined a ready command of language and a trenchant satire never exceeding proper bounds, which made every essay from his pen, and, still more, every word from his mouth, produce its effect. The Military Academy has lost by his death, not only one of its ablest workers, but also one of its strongest and most fearless champions.

Soon after the last annual examination of cadets, the rumor became prevalent that, by the recommendation of the Board of Visitors, this aged professor, now in his seventieth year, was to be removed from active duty at the Academy, and placed upon the retired list. Though on the score of years, and under the usage of the military service, he might have claimed this as his right, this unlooked-for action of the Board came to him, not as a measure of relief from arduous duty, but as a vital assault upon his life-long work and reputation. The shock was too great for him to bear; and when he returned to his post in September, after the usual summer season of relaxation, it was but too evident that his sensitive brain had received a fatal blow. On the 16th of September he left West Point, with an attendant, by the steamer Mary Powell, for the purpose of consulting his physician in New York. When the boat was near Stony Point, he passed rapidly out of the saloon where he had been sitting, and rushing to the side of the boat, just in front of the wheel, he disappeared beneath the waters of the Hudson. Thus ended the life of this most distinguished son of our Military Academy, one of the ablest expounders of engineering science, one of the most zealous, judicious, and successful workers in the cause of education.

SAMUEL FINLEY BREEZE MORSE died at his residence in the city of New York on the 4th of April, 1872.

He was born in Charlestown, Massachusetts, April 27, 1791. He was the eldest son of Jedediah Morse, D. D., an American clergyman and geographer, who was for thirty-one years pastor of the First Congregational Church in Charlestown.

Mr. Morse was a graduate of Yale College, in the class of 1810. He went to Europe during the next year, making the voyage with Washington Allston, and became a pupil, in painting, of Benjamin West.

In addition to his studies in painting, he gave attention to sculpture, and in 1813 received the gold medal of the Adelphi Society of Arts, for an original model of a " Dying Hercules."

He returned to the United States in 1815. In 1824 – 25, with some other artists of New York, he originated a drawing association, which resulted in the establishment, a year later, of the "National Academy of Design." He held the office of President of this society for fifteen years.

In 1829, he again visited Europe, to complete his studies in art, and resided, about three years, in the principal cities of the Continent.

On the return voyage from France, in 1832, on the ship Sully, the feasibility of an electric telegraph was often the subject of conversation, and at that time he made drawings of apparatus intended for this purpose. His first instrument was finished at New York in 1835, and worked in one direction. In July, 1837, he had two instruments, one at each terminus, and could communicate in both directions.

At the close of that year he was at Washington, a petitioner to Congress for aid to construct an experimental line from that city to Baltimore. No appropriation was made during the session of 1837-38, and he went again to Europe.

A patent for his system of telegraphing was refused in England; in France, he obtained a *brevet d'invention*, but it proved to be of no value. He returned to the United States, and, after several years of disappointment and poverty, his appeal to Congress was successful,— the sum of thirty thousand dollars being appropriated on the 4th of March, 1843, for the purpose of encouraging his first attempt to construct a line of electric telegraph between Washington and Baltimore, a work which, after many difficulties, he completed in 1844.

This system has now been in use twenty-eight years; its simplicity, as compared with other kinds of electric telegraph, has favored its general introduction both at home and abroad. In this, as in all important inventions, the practical result is reached by long and patient efforts of many minds, in various departments of scientific and mechanical labor. The world is greatly indebted to Mr. Morse for his perseverance and earnest labor in combining the various parts that constitute the present "Electro-magnetic Telegraph."

This system is now found in operation in all quarters of the world, and has, on many land lines, displaced the needle telegraph. It is not of value for the Atlantic cable or other submarine lines, as they are worked, in all cases, without the use of an electro-magnet.

Mr. Morse received many honors and marks of distinction abroad, and from ten foreign governments the sum of four hundred thousand francs as an honorary and personal award for his useful labors.

He was appointed one of the United States Commissioners to visit the Paris Universal Exposition of 1867, and make examination of telegraphic apparatus. His report on this subject was published in 1869.

CHARLES JACKSON, JR., as he always called himself long after his father's death, was the only son of the Hon. Charles Jackson, one of the judges of the Supreme Court of Massachusetts from 1813 to 1823, and Fanny (Cabot) Jackson, his second wife. He was born on the fourth day of March, 1815.

He was fitted for college chiefly at the schools of Mr. Daniel Greenleaf Ingraham and Mr. William Wells. He entered Harvard College at Commencement, in the year 1830, joining the Sophomore Class. Without aiming at college rank, he held a very creditable position as a scholar.

On leaving college, he began the study of the law with his father, and continued it in the office of the Hon. Charles Greely Loring. He was admitted to the Suffolk Bar in 1836. The years 1837 and 1838 he spent in Europe. On his return, he gave his attention to the study of civil engineering, and was employed on the Western and Eastern railroads during the years 1839 and 1840. After 1840, he devoted himself to iron-making, becoming largely interested in mines and furnaces in Pennsylvania, and continued in this business to the close of his life.

From his college days he was recognized as a man of singularly acute and original intellect. He took nothing on trust which he could study out for himself. With an ever-active thirst for knowledge, a marvellous rapidity and accuracy in acquiring information, and a memory so remarkable that some almost incredible feats are told of it, he was less generally known than many men much his inferiors who care more for fame or notoriety. He was full of knowledge on a great variety of subjects, and talked with an affluence of expression and a knowledge of facts which always commanded the attention of those around him. His business capacity was remarkable, and though he had some trying experiences early in his career, his indomitable courage and clear, cool head carried him safely through them all, and brought his extensive plans to a complete and eminently successful fulfilment.

Mr. Jackson very rarely appeared before the public in any other light than as a man of business. He wrote as he talked, with a facility and rapidity and fertility very rarely equalled, as many of his letters remain to show, — letters as impetuous, as ingenious, as close in argument, as vivid in illustration, as if they were verbatim reports of his brilliant conversation. But I am not sure that he ever printed more than one paper, or delivered more than a single lecture.

In the "North American Review" for October, 1852, is a paper written by him on the subject of the Great Exhibition. It is a very spirited essay, taking the side of the practical workman as an inventor against the pretensions of the man of science. All the characteristics of his mind are very well represented in this essay, which can be read to-day with as much instruction and entertainment as when it was written. He may have pressed his argument at some points, but it is a very striking plea for the discoveries and inventions of the workshop as against those of the laboratory.

In the winter of 1853 - 54, Mr. Jackson delivered a lecture, in the course instituted by the Academy, on the "History of the Useful Arts." This lecture was distinguished by the same qualities which characterized the essay in the "North American Review." Some of its conclusions were startling; but, if not proved, they were supported by such an array of facts, so ingeniously presented, as to offer a formidable front to an opponent. Most of the inventions claimed by Englishmen, as I remember this lecture, were proved or alleged, with a greater or less show of evidence, not to have come from men of Anglo-Saxon birth, that particular stock never having distinguished itself by inventive talent. The lecture was listened to with great interest, and some of its conclusions were, I think, controverted; but it was an effort which showed the keen iconoclastic radicalism of his intellect in its fullest development.

Mr. Jackson's personal character, his fidelity in friendship, the warmth of his attachments, his generous hospitality, added to the attractions of his companionship, made him a great favorite with those who enjoyed the privilege of his intimate acquaintance.

He died, after a protracted illness, on the 30th of July, 1871, leaving a widow and three children, two sons and a daughter. His eldest daughter, the wife of the Rev. George Folsom, died one month before her father.

JAMES DAVENPORT WHELPLEY was born in the city of New York, January 23, 1817, and died in Boston, April 15, 1872. His father, Philip Melancthon Whelpley, was pastor of the First Presbyterian Church in New York City. His grandfather was the Rev. Samuel Whelpley, a distinguished writer and theologian. His mother was Abigail Fitch Davenport, a granddaughter of the Rev. John Davenport, one of the founders of the New Haven colony. He was sent to school at New Haven, where, at an early age, he showed a decided taste for chemical study and experimentation. He entered Yale College in 1833, and was graduated in 1837. In his Senior year he published in the "American Journal of Science" a paper "On two American Species of the Genus Hydrachna," in conjunction with Mr. J. D. Dana, then assistant to Professor Silliman.

Soon after leaving college he joined the corps of Professor Henry D. Rogers, then occupied in surveying the anthracite region of Pennsylvania. After three years' service upon this survey, he studied at the Medical School in Pittsfield, Massachusetts, and, having received the degree of that school, he practised medicine in Brooklyn, New York, until forced by ill health to relinquish his profession.

He then returned to New Haven, and devoted himself to scientific and literary study for a period of eight years. At this time, he conceived the idea of a Philosophical System, to the development of which he devoted much time and thought. Some fragments of this work have been published in the "Proceedings of the Academy," and elsewhere, and much manuscript matter relating to it remains in the possession of his family. During his residence in New Haven, he published in the "American Journal of Science" (1845) a remarkable memoir on the "Idea of an Atom, suggested by the Phenomena of Weight and Temperature."

In 1847, he went to New York, and became editor and partial owner of the "American Whig Review." In 1849, while occupied in editing the Review, he conceived the idea of establishing a commercial colony in Honduras, for the purpose of developing the resources of that country, and bringing it into closer relations with the United States. He at once proceeded to obtain from the Honduras government grants of land and various commercial privileges, and spent two or three years in San Francisco editing a daily newspaper, which he had purchased there, as a means of making his plan known. He had secured a large number of emigrants, and was engaged in perfecting the arrangements for establishing his colony, when he learned that the filibuster Walker had taken forcible possession of Honduras. Dr. Whelpley immediately left San Francisco with an armed party of fifty men, to protect the interests of his projected colony. But his party was captured by that of Walker, and Dr. Whelpley was himself impressed into Walker's service, and put in charge of the sick and wounded men.

He was detained by Walker for nearly a year, suffering meanwhile great privations. He finally escaped to San Francisco, and thence returned in 1856 to New York, where he supported himself for a time by writing short articles for the magazines upon the most varied subjects, — History, Politics, Music, and Romance, as well as Science. Some of these literary diversions, published in the "Atlantic Monthly," bear witness both to the fluency of his pen and to his extraordinary power of imagination.

Henceforward, in spite of frequent severe attacks of asthma and other pulmonary troubles, and almost incessant physical pain, he devoted much time to the study of mechanics, and the invention of machines for saving labor and fuel. His exceedingly ingenious and efficient devices for crushing and pulverizing rocks and ores, for burning fuel in the state of powder, and for applying the heat of the fuel thus burned to the reduction of metallic ores, and to the generation of steam, are familiar to many members of the Academy. Descriptions of them have been widely published in the journals relating to mechanics and metallurgy.

An ingenious steam-engine of his own invention was exhibited at the Institute of Technology in the winter of 1869 – 70. During the last twenty years of his life he was deeply interested in the study of engines, — hot air, gas, and steam, — and he has left nearly three hundred original designs for their construction. His most recent contribution to scientific literature was a series of articles in Van Nostrand's "Engineering Magazine." The last of these papers, published in January, 1872, was entitled "A Critical Examination of the Ideas of Inertia and Momentum."

Dr. Whelpley was remarkable both for his power of abstract reasoning and for the vivacity and scope of his imagination. His was essentially a deductive and inventive mind. Its chief defect was its immense versatility. By mere power of concentration and force of will, he kept at bay the physical pain and distress incident to the pulmonary disease which harassed his later years. The most severe illness hardly seemed to impair in the least degree the acuteness of his intellect; though, during the last few years of his life, his condition was such that he was compelled to avoid all social intercourse, and to abstain absolutely from discussion. It was a source of deep regret to him, that he could not even attend a meeting of the Academy, much less present or defend his views before it, except under the penalty of great pain and alarming illness. From a final attack of this kind was developed the acute consumption of which he died. Dr. Whelpley was a man of rare conversational powers and ready wit, and he had a great fund of information in matters relating to literature and the arts and sciences. He possessed, moreover, in a marked degree, the power of attracting to himself devoted friends. He was esteemed by those who knew him intimately to be a high-minded, honorable gentleman, of warm impulses and attachments, and generous and self-sacrificing to a fault.

Six hundred and forty-seventh Meeting.

September 10, 1872. — STATED MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read letters from Professor Jowett, of Oxford, and Professor Rammelsberg, of Berlin, acknowledging their election into the Academy.

The President announced the death of M. Delaunay, Foreign Honorary Member, and of General Sylvanus Thayer.

The President called attention to a bound volume of several articles, in manuscript, of Count Rumford, presented by Professor Dumas to the Library of the Academy.

It was voted that the thanks of the Academy be tendered to Professor Dumas for this most acceptable donation.

The President called attention to the loss the Academy had sustained in the death of Dr. Francis Dana, for many years Assistant Librarian.

Six hundred and forty-eighth Meeting.

October 9, 1872. — ADJOURNED STATED MEETING.

The PRESIDENT in the chair.

The President announced the death of Professor Francis Lieber, of New York, Associate Fellow of the Academy.